What's New in Anesthesia

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> We must not only search for, and procure a greater number of experiments, but also introduce a completely different method, order, and progress of continuing and promoting experience.
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> FRANCIS BACON, *Novum Organum;* Aphorisms. Book 1, *C.*

AS space and time have neither beginning nor end, so too, with man's ingenuity, new things will continue to be accomplished. In the second book of his *Advancement of Learning* Francis Bacon asks the question, "Why should a few favourite authors stand up like Hercules' Columns, to bar further sailing and discovery . . .?" Farther on he quotes from Homer's *Hymn to Pan* that "The ancients have, with great exactness, delineated universal nature under the person of Pan." Among the many titles of this ancientest of gods was "president of the mountains"; and he had the power of striking terrors, especially such as were vain and superstitious, whence they came to be called *panic* terrors. The fable is, perhaps, the noblest of all antiquity, and pregnant with the mysteries and secrets of nature. Bacon points out that Pan was made god of seekers after every natural action, every motion, every process.

Since the days of Bacon and seemingly following his admonition, his counsel, there have been innumerable and prodigious advances in all branches of science. Just now, as is pointed out by E. U. Condon, director of the National Bureau of Standards (Science, January 2, 1948), we are at the threshold of an unimaginable mastery of our material environment, "for science, which provides that mastery, is in its Golden Age." Doctor Condon very plainly sounds the warning note that, "From one point of view life today is a race—a race between knowledge in the physical sciences, which gives material mastery, and general ignorance, which retards or rejects mastery of our environment. Rejection means no more and no less than destruction of civilization as we know and cherish it." One of his many profound and cogent statements is that "Radioactive isotopes will permit us to explore the structures and constitution of molecular aggregates, for such isotopes can be introduced into a system as scientific detectives . . . they can be traced and studied by means of the radiation they emit. Tracer studies of this kind will unravel secrets in biology, physiology, medicine, chemistry, and metallurgy." By the application of this method of investigation we may expect also to have solution of some of the problems which particularly concern the anesthetist. This constitutes something new in anesthesiology, and I know that among others, Tuohy[16] of Georgetown University, Washington, D. C., is actively engaged in investigation involving isotopes.

We may expect valuable new discoveries from tracer studies in salt and water metabolism, in the inorganic as well as in the organic compounds of phosphorus, and in protein metabolism. Indeed, several such studies are being made at present. The anesthetist is interested in some of these. Early last year were published the Croonian Lectures of Marriott,[12] delivered at the Royal College of Physicians in London. They were on *Water and Salt Depletion.* Although this is an old subject, he throws new light upon it as he draws attention to the consequences of wrong treatment and the serious pitfalls in the treatment of different types of dehydration and salt depletion. "The subject is far from being as simple as is often assumed—an assumption which may lead to the control of water and salt administration being left to nurses or junior residents. The essential principle in the treatment of water and salt depletion is that the patient shall be given water or salt, or both, in the amounts that each is lacking. Therefore, as in all conditions, correct diagnosis—in this instance quantitative as well as qualitative—is essential to correct treatment." He gives the facts and principles on which diagnosis depends and points out that "the main questions which arise in practical treatment are: (1) What fluid should be administered? (2) How much? (3) By what route? (4) At what rate?" He deals with each of these very comprehensively, gives definite rules to follow and finishes with the statement: "Water and salt are, perhaps, practically the most important substances it is in our power to administer. They can be so used that they can achieve seeming miracles; or they can be so misused as to lead to a fatal issue. Their proper use is not the simple matter it is often assumed to be."

Marriott intimates that further study is needed particularly of the electrolytes and the acid-base balance. Tracer studies may lend a hand here as we mark sodium, potassium and phosphorus. The physician-anesthesiologist, he of the younger generation, has much with which to indulge his imagination, he may feel the sentiment of the physician-poet, John Keats, in his *Fancy*:

> Ever let the Fancy roam,
> Pleasure never is at home:
> At a touch sweet Pleasure melteth,
> Like to bubbles when rain pelteth;
> Then let winged Fancy wander
> Through the thought still spread beyond her:
> Open wide the mind's cage-door,
> She'll dart forth, and cloudward soar.

During the whole of 1947, midst continuing clouds of social unrest, anesthesia received so many new additions that I know not how to do more than mention some in passing. Smith[14] allowed himself to be the

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subject of experimentation while his collaborators made observations. It turned out that his own observations were most valuable. He was given, intravenously over a period of 33 minutes, "a dose of *d*-tubocurarine chloride two and one-half times that necessary for complete respiratory paralysis and adequate for complete skeletal muscular paralysis . . . Inasmuch as no changes occurred in the electroencephalogram, consciousness and sensorium, or in any aspect of higher central nervous system function, it is concluded that *d*-tubocurarine chloride has no significant central stimulant, depressant or analgesic action. Attention is called to the importance of this observation for the proper use of curare as an adjuvant in anesthesia." This last statement is made in spite of the excellent results which Smith obtained when he used curare as the sole agent to provide satisfactory conditions for various types of surgical procedures in infants and children.[15]

Dripps and Sergent[7] reported on the utility of a new curare-like substance, namely, dihydro-beta-erythroidine. This drug paralyzes conduction through the neuromyal junction and has the advantage over curare of not causing the liberation of histamine. (Comroe and Dripps[6] had previously reported that following the administration of curare and some of its derivatives, reactions occurred in the form of skin wheals, bronchospasms, depression of blood pressure and hemorrhage into the intestinal tract. The clinical significance of these reactions to the anesthesiologists is not as great as to physicians who might employ curare in unanesthetized patients. The reason for this is that anesthesia decreases all anaphylactic and allergic responses, and liberation of histamine falls in this category. Certain it is that bronchospasm and hypotension are seen in anesthetized patients but they estimate the incidence of this to be under 0.5 per cent.)

A disadvantage of the new curare-like substance is its tendency to cause a great depression of blood pressure. It is a crystalline substance which can be weighed out accurately and need not be subjected to bio-assay. Comroe and Dripps are continuing to use it. Griffith of Montreal, it is true, did make a great contribution to anesthesia when, in 1942, he introduced the use of curare.

Quite recently, Dripps and his co-workers have made several valuable additions to knowledge in anesthesia. I shall tell of two more of them:

1. Their work on the responses of normal man to low oxygen mixtures.[8] It was interesting to note that the respiratory response was an unpredictable affair and it was not until mixtures as low as 10 per cent oxygen were reached that there was any major respiratory stimulation. Even at 8 per cent oxygen, some people showed no increase in breathing. This is contrary to the teaching in the current textbooks of physiology. They found that the pulse rate was a better index of hypoxia than was respiration. Even at 16 to 18 per cent oxygen there was some increase in pulse rate and this progressed in a straight line relationship. This fundamental type of work they plan to extend to anesthetized subjects. They say that "as anesthesiologists we must not only know what normal man does but be also concerned with how these responses are affected by narcosis."

2. They present data which suggest that the hypotension not infrequently seen at the conclusion of cyclopropane anesthesia is related in part at least to an abnormally high level of carbon dioxide in the arterial blood during anesthesia.[9] This increase in arterial carbon dioxide tension results from the respiratory depressant action of cyclopropane. In an empirical manner, I have noticed for quite some time that through the reduction of the oxygen percentage by the addition of nitrogen so that during the administration of cyclopropane there will be approximately 20 per cent of cyclopropane, 30 per cent of oxygen and 50 per cent of nitrogen, this "cyclopropane shock" does not occur. I do not know how to explain, and it would seem that still further investigation is needed.

While on the theme of cyclopropane, it is important to recount that Beecher[2] and his associates have just completed some works "which indicate that the circulation in the capillary beds is cut down by cyclopropane. This is inferred from the marked curtailment of lymph flow collected under standardized conditions. This also fits in well with the observations of Chambers and Zweifach, who observe that "the capillary beds under cyclopropane were far less active than under ether." And they "have measured the renal blood flow, by the technics of Homer Smith, in man and have found that cyclopropane produces considerably greater restriction of renal plasma flow than was the case under ether. These observations all fit together." Beecher[2] has made several interesting and valuable contributions to the literature of anesthesia during 1947, and lately has told me that "another line of work which will soon be ready for publication is our study of the great family of amidones. I do not believe it is too strong a statement to make, to say that these constitute the greatest advance in the field of narcotics that has transpired in decades."

Through the past year Burstein and his associates have been doing some good work on anesthesia for thoracic surgery,[3] in which they stress the importance of protecting the patient from untoward reflex changes, the importance of ample oxygenation and of carbon dioxide elimination. Their technique is so substantial that it permits of momentary modifications and changes, and they practice "compensated respiration," a term applied to the assisting of spontaneous breathing in combating "pulmonary decompensation." Burstein[4] has developed some newer concepts in the utility of intravenous procaine to reduce cardiac irritability during general anesthesia and to prevent cardiac hyper-irritability in patients with pre-existing cardiac disease who are to be anesthetized with cyclopropane. The dose of procaine has been increased from 50 mgm. to 100 mgm. in a 1 or 2 per cent concentration. In an excellent review, Trifari and Martin[17] bring the subject of intravenous anesthesia right up to date, and comment very favor-

ably on the employment of this method of giving pentothal, curare, procaine and morphine.

Properly to answer the question "What's New in Anesthesia?" would require much more time than is practical in a restricted symposium, it may suffice therefore just to mention a few more new things which are at the moment particularly appealing. New vasopressor drugs continue to come to the fore, for example that described by Jackson[11] and called EA-83, or 2-methylamino-6-hydroxy-6-methyl heptane, or 2-methylamino iso-octanol. He categorizes it as sympathomimetic and finds it to hold special promise as a strong heart and circulatory stimulant in cases of circulatory collapse. Barrett[1] has described the analeptic effect of sodium succinate on barbiturate depression in man. He thinks very highly of this substance. Spinal anesthesia in obstetrics is on the increase and has been dealt with very comprisingly by Cullen and Griffith.[5] Then there are the studies on diffusion respiration by Draper, Roth, Spencer and Whitehead.[13] These laboratory workers attribute the survival of dogs, purposely subjected to respiratory arrest under controlled conditions, to the existence of diffusion respiration; and they supply several informative data. Lastly, I shall mention the "jet injection" or hypospray brought forward by Hingson and Hughes[10] and being used concomitantly by Tuohy.[16] They give several possible disadvantages to this new method, but point out as many advantages. They believe the use of the "instrument offers real promise to the medical profession."

It must be said, in conclusion, that I do really believe that the best of all that's new in anesthesia is *the new and widespread interest in the provision of opportunities for those who desire to learn anesthesia.* For each young aspirant, let us increase the timeliness to unfold inclination and to develop thought. Then, with feeling, he may say, with Emerson:

I am not poor, but I am proud,
Of one inalienable right,
Above the envy of the crowd,—
Thought's holy light.

Better it is than gems or gold,
And oh! it cannot die,
But thought will glow when the sun grows cold,
And mix with Deity.

THOUGHT

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QUESTIONS AND ANSWERS

Question: Dr. Bourne, what are the added dangers in spinal anesthesia in obstetrics, and how may these be prevented or modified?

DR. BOURNE: The chief danger is the likelihood of the anesthesia becoming too high, seemingly on account of the increased intra-abdominal tension in pregnancy. Small doses of whatever drug is used ought to be employed and they should be made heavy by using a solvent of 10 per cent dextrose. Air bubbles must be avoided, injection ought not to be made while the uterus is contracting, and the patient must be postured with great care. An analeptic should be in readiness for prompt intravenous administration should the blood pressure fall immoderately, and oxygen ought to be given routinely. Another danger, or rather, disadvantage, is that of headaches. These are more apt to occur after spinal analgesia in obstetrics than otherwise, perhaps on account of the greater activity of the patient. These headaches may be modified by closer attention to posture and by the judicious increase in the use of sedatives.